Registered nurse-led emergency department triage:
organisation, allocation of acuity ratings and triage decision making

To my mother,
without her, this dissertation would never have been written

Örebro Studies in Caring Sciences 10

Katarina Göransson

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Abstract

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Successful triage is the basis for sound emergency department (ED) care, whereas unsuccessful triage could result in adverse outcomes. ED triage is a rather unexplored area in the Swedish health care system. This thesis contributes to our understanding of this complex nursing task. The main focus of this study has been on the organisation, performance, and decision making in Swedish ED triage. Specific aims were to describe the Swedish ED triage context, describe and compare registered nurses' (RNs) allocation of acuity ratings, use of thinking strategies and the way they structure the ED triage process.

In this descriptive, comparative, and correlative research project quantitative and qualitative data were collected using telephone interviews, patient scenarios and think aloud method. Both convenience and purposeful sampling were used when identifying the participating 69 nurse managers and 423 RNs from various types of hospital-based EDs throughout the country.

The results showed national variation, both in the way triage was organised and in the way it was conducted. From an organisational perspective, the variation emerged in several areas: the use of various triageurs, designated triage nurses, and triage scales. Variation was also noted in the accuracy and concordance of allocated acuity ratings. Statistical methods provided limited explanations for these variations, suggesting that RNs' clinical experience might have some affect on the RNs' triage accuracy. The project identified several thinking strategies used by the RNs, indicating that the RNs, amongst other things, searched for additional information, generated hypotheses about the fictitious patients and provided explanations for the interventions chosen. The RNs formed relationships between their interventions and the fictitious patients' symptoms. The RNs structured the triage process in several ways, beginning the process by searching for information, generating hypotheses, or allocating acuity ratings. Comparison of RNs' use of thinking strategies and the structure of the triage process based on triage accuracy revealed only slight differences.

The findings in this dissertation indicate that the way a patient is triaged, and by whom, depends upon the particular organisation of the ED. Moreover, the large variation in RNs triage accuracy and the inter-rater agreement and concordance of the allocated acuity ratings suggest that the acuity rating allocated to a patient may vary considerably, depending on who does the allocation. That neither clinical experience nor the RNs' decision-making processes alone can explain the variations in the RNs triage accuracy indicates that accuracy might be influenced by individual and contextual factors. Future studies investigating triage accuracy are recommended to be carried out in natural settings.

In conclusion, Swedish ED triage is permeated by diversity, both in its organisation and in its performance. The reasons for these variations are not well understood.

Keywords: Accuracy, Canadian Triage and Acuity Scale, concordance, decision making, emergency department, patient scenarios, registered nurses, survey, think aloud, triage.

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Original Publications

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IV Göransson, K. E., Fonteyn, M. E., Ehnfors, M., Ehrenberg, A. Thinking strategies nurses use in emergency department triage. In manuscript.

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Definitions

Accuracy	The ability to target the expected acuity rating
Acuity rating	The level of urgency as defined by a triage scale
Chief complaint	The reason for the ED visit as stated by the patient
Concordance	The agreement between the RNs' acuity ratings
Expected acuity rating	The acuity rating allocated by the developers for each of the 18 patient scenarios
Modal acuity rating	The most frequently chosen acuity rating for one scenario
One – two tier system	Triage systems where triage is carried out by one triageur while in a two-tier system triage is performed in two steps
Over-undertriage	A more acute rating than required (over) or a less acute rating than required (under)
Triage	The initial assessment and judgement about health care-seeking persons' need for emergency care
Triageur	The person performing triage on newly arrived patients in emergency care

Sammanfattning

Sjuksköterskeledd akutmottagningstriage: organisation och utförande vid svenska sjukhus

Bakgrund

I engelsktalande länder är *triage* ett vanligt förekommande begrepp för att beskriva den process där sjuka och skadade människors behov av vård bedöms (baserat på deras symtom) och graderas (utifrån deras medicinska angelägenhetsgrad). Någon svensk översättning existerar inte, och det engelska ordet används därför i avhandlingen. Triage kan utföras i olika typer av miljöer, såväl prehospitalt som vid vårdinrättning, och dess syfte samt tillämpning påverkas av var det utförs. Vid akutmottagningstriage är det övergripande syftet att bedöma och gradera vårdsökande personers medicinska angelägenhetsgrad, baserat på deras symtom och sökorsak. I flertalet anglosaxiska länder har akutmottagningstriage uppmärksammats, såväl vetenskapligt som kliniskt, i flera decennier. Däremot råder det brist på publicerade studier som rör Sverige samt forum där kliniskt verksamma kan samlas för att diskutera och utveckla triageprocessen.

Syfte

Det övergripande syftet med avhandlingsarbetet var att undersöka sjuksköterskeledd akutmottagningstriage. Avhandlingen bygger på fyra delarbeten, det första från ett organisatoriskt perspektiv och övriga från akutsjuksköterskans perspektiv. Specifika mål var att beskriva triagekontexten för svenska akutmottagningar, beskriva och jämföra akutsjuksköterskors triagegraderingar samt deras beslutsfattande i triageprocessen:

- Att beskriva hur triagerelaterat arbete organiserades och utfördes vid svenska akutmottagningar (delarbete I)
- Att beskriva och jämföra träffsäkerhet och samstämmighet i sjuksköterskors triagegraderingar (delarbete II)
- Att identifiera samband mellan sjuksköterskors träffsäkerhet i triagegraderingar och individuella karakteristika (delarbete III)
- Att beskriva och jämföra sjuksköterskors kognitiva strategier och strukturerande av triageprocessen (delarbete IV).

Material och metod

Ett flertal metoder användes för att samla in data: telefonintervju, patientfall och ”think aloud- metod”. Tabell 1 illustrerar samtliga delarbeten med tillhörande design, urval, datainsamlingsmetod samt analysförfarande. I delarbetena I–III tillfrågades samtliga sjukhusanslutna akutmottagningar i Sverige (N=79), medan urvalet i det sista delarbetet (IV) vägleddes av metodologiska överväganden. Sammanlagt deltog 69 (87%) chefsjuksköterskor och 423 (29%) legitimerade sjuksköterskor från olika typer av sjukhus från hela landet i delarbetena. Såväl bekvämlighets- som ändamålsenlig urvalsprocess användes i delarbetena.

Instrumenten som användes i delarbetena utvecklades av forskargruppen och baserades på litteraturstudier samt gruppens kliniska erfarenhet. Intervjuguiden i delarbete I innehöll 36 frågor fördelade på fyra områden: sjukhusets demografiska data, akutmottagningspersonal, kunskap om riktlinjer och lagstiftning om triagearbete, beslutstöd samt avslutningsvis triageskalor. I delarbetena II och III användes 11 studiespecifika frågor samt ett formulär med 40 fiktiva patientfall och 11 avslutande frågor om personliga karakteristika. Även i delarbete IV användes patientfall (n=5).

Kvantitativa data analyserades såväl deskriptivt som med inferensstatistik, medan kvalitativt material analyserades med innehållsanalys. Arton av de 40 patientfall som användes i delarbetena II och III ligger till grund för statistiska analyser, då dessa hade en interbedömarreliabilitet på 80% eller högre. Dessa 18 patientfall erhöll en förväntad triagenivå, och de har använts vid analys av träffsäkerhet av sjuksköterskornas triagegraderingar.

Kvalitativa data analyserades i flera steg. Inledningsvis utfördes deduktiv innehållsanalys, baserad på i litteraturen beskrivna kognitiva strategier, följd av identifierande av en profil[1] för varje sjuksköterska. Avslutningsvis jämfördes sjuksköterskornas användande av de kognitiva strategierna samt profilerna baserat på träffsäkerhet i triagegraderingar genom att gruppera sjuksköterskornas verbala protokoll i hög respektive låg träffsäkerhet.

Tabell 1. Schematisk översikt av delarbetena i avhandlingen

Delarbete	Design	Urval	Datainsamling	Dataanalys
I	Deskriptiv Nationell kartläggning	69 chefsjuksköterskor eller motsvarande vid sjukhusanslutna akutmottagningar (n=69)*	Strukturerade telefonintervjuer	Deskriptiv statistik: -Frekvenser (antal och procent)
II	Deskriptiv Komparativ	423 sjuksköterskor från sjukhusanslutna akutmottagningar (n=48)*	Patientfall Studiespecifika frågor	Deskriptiv statistik: -Frekvenser (antal, procent, medelvärde och range) -Cohen's kappa
III	Deskriptiv Komparativ Korrelativ	423 sjuksköterskor från sjukhusanslutna akutmottagningar (n=48)*	Patientfall Studiespecifika frågor	Deskriptiv statistik: -Frekvenser (antal, procent, medelvärde, range och SD) Inferensstatistik: -Pearson's correlation coefficient -95% konfidens-intervall -ANOVA
IV	Deskriptiv Komparativ	16 sjuksköterskor från sjukhusanslutna akutmottagningar (n=13)*	Patientfall Think aloud	Kvalitativ innehållsanalys

* Akutmottagningar som behandlar vuxna sjuka och skadade patienter

Resultat

Delarbetenas resultat visar att svensk akutmottagningstriage genomsyras av variation, såväl på det sätt som triage organiseras som hur det utförs. De organisatoriska skillnaderna visas bl.a. genom variationen i nyttjande av särskilt utsedd triagesjuksköterska, vilket användes dygnet runt av 14 (20%) sjukhus för gående patienter och 5 (7%) för ambulansanländande patienter. Vid ett flertal (81%) av de 69 medverkande sjukhusen påbörjades triagebedömningen för gående patienter av sjuksköterskor eller personal med lägre medicinsk kompetens. Ytterligare organisatoriska skillnader var användandet av triageskalor, där drygt hälften (54%) av sjukhusen använde någon form av triageskala. Dock varierade designen avseende antal steg och tidsintervall för respektive steg i stor utsträckning. Fyra sjukhus som var bemannade med särskild triagesjuksköterska arbetade utan triageskala, medan 17 sjukhus utan motsvarande tjänst använde någon form av triageskala.

Variationerna var även tydliga i sjuksköterskornas triagegraderingar, både vad gäller träffsäkerhet och samstämmighet. Sjuksköterskornas interbedömarreliabilitet rörande de 7550 triagebesluten var 57,7% (oviktad κ 0,46 och viktad κ 0,71). Av de felaktiga triagebesluten var 28,4% övertriagerade (graderade som mer akuta) medan 13,9% var undertriagerade (graderade som mindre akuta). Vidare triagerades tio av de 18 fallen över samtliga fem triagenivåer medan inget fall triagerades inom samma triagenivå av samtliga sjuksköterskor. I genomsnitt triagerade sjuksköterskorna 58% (SD 12,8) fall rätt. Dock skilde sig träffsäkerheten mellan 22% och 89% korrekt triagerade fall per sjuksköterska. Statistiska analyser har inte påvisat några förklarande samband mellan sjuksköterskornas personliga karakteristika och träffsäkerhet i triagebeslut.

I arbetet identifierades ett flertal kognitiva strategier som sjuksköterskorna använde för att triagera patientfallen. Sjuksköterskorna efterfrågade ytterligare information, genererade hypoteser om tänkbara orsaker till patientfallens tillstånd och gav förklaringar till valda åtgärder. De skapade även samband mellan valda åtgärder och patientfallens symtom, och tidigare inhämtad kunskap användes för att fatta beslut. Sjuksköterskornas profiler visade att de strukturerade triageprocessen på olika sätt, genom att inleda processen med att antingen efterfråga information, generera hypoteser eller gradera fallets angelägenhetsgrad. Jämförelse mellan sjuksköterskor med hög respektive låg träffsäkerhet i triagegraderingar visade att endast små skillnader fanns vad gäller användande av kognitiva strategier och sjuksköterskornas profiler för triagering.

Slutsats

Avhandlingen visar att svensk akutmottagningstriage genomsyras av variation, såväl på det sätt som triage organiseras som hur det utförs. Majoriteten av sjukhusen har triageorganisationer som inte är baserade på vetenskapligt underlag. Frånvaron av tillförlitliga triageskalor är alarmerande ur såväl patientsäkerhets- som juridiskt perspektiv. Det begränsande användandet av särskilt utsedda triagesjuksköterskor samt det faktum att sjuksköterskor vid många sjukhus baserar sina triagebeslut på bedömningar gjorda av personal med lägre medicinsk kompetens talar för att kompetens och kvalitet vid akutmottagningstriage kan ifrågasättas.

Graden av variationer i sjuksköterskornas träffsäkerhet och samstämmighet att gradera patientfallens angelägenhetsgrad indikerar att dessa variationer, om än inte i samma utsträckning, är möjliga vad gäller triagegraderingar av verkliga patienter. Om så skulle vara fallet är det alarmerande eftersom patientsäkerheten då kan vara hotad. Frånvaron av förklarande samband mellan sjuksköterskornas träffsäkerhet i triagebeslut och variabler som individuella karakteristika, användande av kognitiva strategier och strukturen av triageprocessen indikerar att såväl interna (t.ex. arbetstillfredställelse och tillit till förmågan att klara av uppgiften) som kontextuella (t.ex. arbetsbelastning och tidspress) faktorer kan vara avgörande för sjuksköterskornas triageförmåga.

Introduction

The first time I heard the word triage was during my military officer's training. The concept was taught in the Battlefield Advanced Trauma Life Support (BATLS) course from the military triage perspective. A few years later, when I worked in a civilian emergency department (ED), I was introduced to triage in the ED setting. Even though formalised ED triage was not applied in this health care setting at the time, the registered nurses (RNs) working in the ED assessed and rated health care-seeking persons upon their arrival to the ED. Because no formal triage was carried out, there was no education for this task and hence it was learned by experience and by discussions with colleagues. Triage is an every day task for RNs in the ED, but little attention has been given to this task in the clinical setting in Sweden. In my view, it seemed like the RNs in the ED where I used to work used different approaches when triaging the patients. When I was in the situation to choose a topic for my dissertation, the choice was easy.

It is understandable that triaging a health care-seeking person's need for medical attention may vary depending on who performs the triage. Still, the triage decision and the allocation of an acuity rating have to be accurate, i.e. reliable. The triage decision and acuity rating allocated influence not only the waiting time regarding its length but also the actions taken or not taken during the waiting time, which, in turn, affect patient safety. Further, it is imperative that patients in need of immediate care are identified, as adverse outcomes are otherwise likely to occur. If an RN fails to identify a person with a severe condition (i.e. the person is in need of immediate medical attention), the outcome of such a failure might be harmful, or even fatal. Too often the media report on increased waiting times in the ED. Unfortunately, but perhaps not surprisingly, there are also reports about patients dying while waiting to be triaged or because inappropriate triage decisions were made (Nihlen 2003, Aobadia 2004).

With today's overcrowding in EDs, an ever increasing aging population, and co-morbidities among patients triage is a challenging task. If RNs are to carry out this task and have a good chance of performing well, action needs to be taken. However, this is easier said than done because there is limited knowledge about decision making during triage. Therefore, this dissertation addresses several aspects of ED triage, from describing the current organisation and performance of triage throughout Sweden to investigating RNs' decision making during ED triage.

Background

ED triage is a small but vital part of ED care. As illustrated in Figure 1, it is the initial phase of ED care, regardless of mode of arrival (ambulance or non-ambulance). It is also the point of care where the triageurs make independent decisions regarding patients that they have limited information about. These decisions influence the entire ED visit, decisions that are often made autonomously and under time constraints.

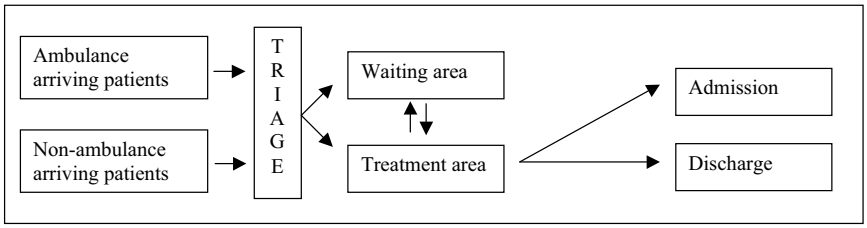

FIGURE 1. Illustration of clinical workflow in the ED

The English word triage, deriving from the French noun *triage* (sorting) and the verb *trier* (to sort), means to judge, sort or pick (Merriam-Webster OnLine dictionary, FitzGerald 1989). From an etymological perspective, the terms *triage* and *trier* stem from the Latin *terere* and *tritare* (which means rub, wear out, tread) (Bloch 1932). Triage, as a concept, is rather new in the Swedish language. However, its content is not new: patients have always been assessed and asked about their chief complaints, but without having a proper term to bind to this action (Andersson et al. 2006). Consequently, by introducing the concept ED triage in the Swedish language, this somewhat hidden ED action can be better visualised. In addition, a common nomenclature for this ED task facilitates communication in Sweden as well as internationally.

The development of triage

ED triage has its foundations in the military setting. Napoleon's chief surgeon, Baron Dominique Jean Larrey, published in the 19th century the rational behind the development of the flying ambulances, *ambulance volante,* where injured soldiers could be attended to much faster, and thus the likelihood of saving more lives increased (Larrey 1812). In addition, Jean Larrey introduced a new way of prioritising the wounded: instead of attending to the injured

based on rank, the order of priority was based on the need for surgical interventions (Richardson 1974). Even though Jean Larrey did not explicitly use the word triage, he is said to be the founder of the process of prioritising the wounded based on their need for care.

Modern civilian and military triage have the same aim as described centuries ago, namely to ensure that the sickest and potentially salvageable patient is treated first (Andrén-Sandberg et al 1993, Försvarsmakten 2001, Gerdtz 2003). In the civilian setting triage can be performed in several environments, including prehospital care (e.g., a mass casualty situation or a disaster situation), non-prehospital setting (e.g., in an ED), and primary health care (Gilboy et al. 2003, Grossman 2003).

In prehospital triage, and especially in a disaster situation, the triage decision is based not only on the injured persons' condition but also on the limitation of resources and other casualties (Andrén-Sandberg et al 1993). In ED triage, however, unless there is a disaster situation, the triage decision is not dependent on the amount of resources, other health care seeking patients' need for care, or waiting times, but rather it is based on each individual's need for emergency care (LeVasseur et al. 2001). Moreover, triage is performed in both somatic and mental health areas, as well as in paediatric and adult care facilities (Gary et al. 2003).

The development of ED triage

The introduction of triage to the EDs first took place in the USA. In the 1950s, there was an increased number of patients seeking care in the American EDs. Accordingly, a more effective and a safer way of rating the patients were needed (Gilboy et al. 1999). The EDs handled the situation by introducing qualified health care personnel, often RNs, to attend to the patients upon arrival to the ED. The RNs performed an initial assessment and rated the patients, aiming at identifying those patients that could safely wait for care and those who were critically ill and thus in need of immediate attention (Purnell 1991). In other words, rating the patients based on their level of acuity of illness or injury, and not on time of arrival, was introduced.

Eventually, the situation with overcrowding in the EDs also occurred in other parts of the world (Thompson and Dains 1982, Gerdtz 2003). In Sweden, there is a lack of information regarding amount of visitors or case mix in the EDs. However, in a report from the Swedish National Board of Health and Welfare it was estimated that there were 2 500 000 visits per year to the EDs (Socialstyrelsen 1995). In addition, there are no national

data on these visitors' trends, neither annually nor in a longer perspective (Green 2005).

It is, however, a common understanding by personnel working in Swedish EDs that the number of patients, including those patients with less urgent conditions, is increasing. During the 1980s and early 1990s, studies showed that an increase in number of patients with less urgent conditions occurred in Sweden also (Magnusson 1980, Edhag et al. 1987, Brismar et al. 1991). Even though different designs and terminologies were used, the studies are concordant in the sense that a large number (38-55%) of health care-seeking persons to the EDs were regarded as less urgent and hence not necessarily in need of the EDs' resources. Another influence on ED overcrowding is the closing down of EDs in Sweden (Socialstyrelsen 1995, HSI 2001), resulting in fewer facilities to handle the growing number of health care-seeking people.

The triageur and triage systems

Although the aim of ED triage is similar across the world, there are variations by whom and how it is carried out. Traditionally, ED triage has been performed by RNs (Purnell 1991, Canadian Association of Emergency Physicians and National Emergency Nurses Affiliation of Canada 1998, Gerdtz and Bucknall 2000). However, the use of less qualified personnel has also been reported (Purnell 1991, Palmquist and Lindell 2000), as well as team triage in which RNs and physicians work together (Subash et al. 2004, Terris et al. 2004). Because the scope of this study is restricted, only RNs as triageurs are examined here.

RN-led ED triage has been described in the literature as one – or two – tier systems. In one-tier systems triage is carried out by one triageur; in a two-tier system, triage is performed in two steps by two triageurs (Thompson and Dains 1982). The interventions conducted during triage may also differ. An initial assessment and allocation of acuity ratings are often performed (Geraci and Geraci 1994, Australasian College for Emergency Medicine 2000). Additional nursing interventions may include initiation or performance of various tests and treatments, reassessment, and supervision during the time the patient waits to see the attending physician (Cheung et al. 2002). In this dissertation ED triage is limited to the initial assessment and allocation of acuity ratings. The scenario below is one example of a one-tier ED triage system based on initial assessment and allocation of acuity ratings.

Nurse X is scheduled for triage during today's shift in the ED. When starting her shift, she looks out in the waiting area. In front of her, five persons are lined up waiting to be triaged by the nurse. The triage nurse[2] quickly looks at the five to determine whether she can identify anyone with signs or symptoms of a severe condition. The fourth person in line seems to be having difficulties breathing, so the nurse makes a gesture to that patient to approach the triage desk. The nurse asks for the patient's chief complaint. Based on the information received from the patient, the nurse allocates a level 2 (rather urgent) acuity rating. Following the allocation of the acuity rating, an RN in the treatment area of the ED attends to the patient; meanwhile, the triage nurse continues her work to triage those persons that are still waiting in line. She again looks over the persons in line, but this time cannot identify anyone with an obvious life-threatening condition. Therefore, the nurse turns to the person next in line. Through information about chief complaints and collection of vital signs, the triage nurse allocates a level 5 (non-urgent) acuity rating, and the patient remains in the waiting room. Then, the triage nurse continues with the next person.

Triage scales

Many Western countries use triage scales to rate and document the patients' level of acuity. A triage scale enables the nurse to make a systematic and comparable triage decision. Several benefits can be achieved by using a standardised triage scale (e.g., intra- and inter-hospital communication, detection of risk for overcrowding and heavy workload, and comparisons with other EDs on a regional and national level). When employing a triage scale, the outcome of a triage decision may fall into one of three categories: an accurate triage decision, overtriage (a more acute rating than required) or undertriage (a less acute rating than required) (Fernandes et al. 2005).

It is essential that the acuity ratings are appropriate because they influence patients' waiting time and future care in the ED (Gerdtz and Bucknall 2001). Four 5-level triage scales have been developed in the past 15 years: the Australasian Triage Scale [ATS], previously known as the National Triage Scale [NTS] (Australasian College for Emergency Medicine 2000, LeVasseur et al. 2001), the Canadian Triage and Acuity Scale [CTAS] (Canadian Association of Emergency Physicians 1998, Murray 2003), the British Manchester Triage Scale [MTS] (Manchester Triage Group 1997), and the Emergency Severity Index [ESI], which was developed by emergency physicians and nurses in the USA (Gilboy et al. 2003). The ATS, CTAS, and MTS are all designed

with a time frame for each triage level, where the time periods are the estimated safe maximum waiting time for triaged patients (see Table 1).

The time levels in the ATS and MTS and in the original version of CTAS are associated with time to treatment, i.e. the triage nurse estimates how long the patient can safely wait for medical assessment and treatment (Australasian College for Emergency Medicine 1993, Manchester Triage Group 1997, Canadian Association of Emergency Physicians 1998, Australasian College for Emergency Medicine 2000).

Table 1. Time levels and use of systematic reassessment in three internationally developed ED triage scales

Triage level	Triage scales		
	Australasian Triage Scale	Canadian Triage and Acuity Scale	Manchester Triage Scale
Level 1	Immediate	Immediate	Immediate
Level 2	Within 10 min	Within 15 min	Within 10 min
Level 3	Within 30 min	Within 30 min	Within 60 min
Level 4	Within 60 min	Within 60 min	Within 120 min
Level 5	Within 120 min	Within 120 min	Within 240 min
Systematic reassessment	No	Yes	No

However, partly because of the inability to fulfil the goals of treating every patient within the period of time associated with the triage level, a revised version of CTAS shifted the focus from time to physician to time to reassessment. The focus on reassessment stems from the aim of making the patients' waiting time as safe as possible, where the responsibility is shared between the triage nurse and the patient (Murray et al. 2004). Neither ATS nor MTS specifies systematic reassessment, but MTS does state that triage is a dynamic process, implicating that patients need to be reassessed regularly (Manchester Triage Group 1997). In ATS it is declared that reassessment should be done if a patient's condition changes while waiting for treatment, or if additional relevant information becomes available that impacts on the patient's urgency (Australasian College for Emergency Medicine 2000).

ESI has a somewhat different design than the above mentioned 5-level scales (Gilboy et al. 2003). First, there are no time frames associated with each triage level, and second, the scale aims not only to identify and rate the patients' acuity, but also adds a logistic perspective (for level 3–5 patients).

By estimating how many resources (e.g., X-ray, laboratory tests) the patient is likely to require during the ED visit, the triage nurse adds such information when allocating the triage level for patients with acuity levels from 3-5 (Wuerz et al. 2000).

The triage scales presented above have been investigated for reliability and validity to various degrees. However, the use of several methods for data collection (e.g., patient scenario, chart audit, and parallel, blinded triage), along with different methods of data analysis (e.g., weighted/unweighted κ statistics and agreement within one level), makes it somewhat difficult to compare and draw conclusions from the results of studies on the different scales.

Analysis of ATS has shown varying results regarding reliability (Jelinek and Little 1996, Dilley and Standen 1998, Goodacre et al. 1999, Considine et al. 2000), but indicates correlations between triage levels, mortality, and admittance to hospital (Hollis and Sprivulis 1996, Richardson 1998, Dent et al. 1999, Doherty et al. 2003). Reliability of CTAS has been investigated thoroughly, with the majority of studies (e.g., Beveridge et al. 1999, Manos et al. 2002, Worster et al. 2004) showing good to very good results. Only one study (Beveridge and Ducharme 1997) has evaluated the validity of CTAS, finding that the triage levels are correlated with admittance and length of stay in the ED.

MTS has been investigated only sparingly, but has shown fair to good agreement (Cooke and Jinks 1999, Goodacre et al. 1999, Dann et al. 2005). Finally, a large number of studies have investigated ESI, with good to very good reliability being reported (e.g., Wuerz et al. 2000, Eitel et al. 2003, Tanabe et al. 2004). Studies on ESI have also shown that triage levels correlate with admission and mortality (Wuerz et al. 2000, Wuerz 2001, Wuerz et al. 2001). There are no published scientific studies on Swedish ED triage scales. The National Board of Health and Welfare reported that a 3-level scale is common in Swedish EDs but that the definitions of need for care differ among the hospitals. The report suggests that the third level on the scale might be transformed into three subcategories, making it a 5-level triage scale (Socialstyrelsen 1994). This 3-5-level scale is not similar to any of the internationally accepted triage scales because the time frames used are longer in the Swedish version.

Triage and decision making

Decision making is an integral part of modern nursing practice, where it is as common in the triage context as in other nursing settings. The triage context is characterised by decision making under uncertainty (e.g., lack of relevant data in combination with limited time resources), a situation that influences the decision-making process (Hamm 1988). Another factor that influences the triage nurse's decision making is the geographical isolation of the nurse, which obstructs communication with colleagues (Gerdtz and Bucknall 1999). ED triage has been defined as the decision-making process used to rate a patients' need for medical care based on their chief complaints (Gerdtz 2003).

Many studies investigating triage nurses' decision making are made from an intuitive perspective (Thompson and Dowding 2002), i.e. they are done in relation to the triage nurses' clinical experience (e.g., Cone 2000, Ferrario 2001, Dello Stritto 2005). Probably the most well known nursing scholar advocating the intuitive perspective is Patricia Benner. In the 1980s, Benner published her seminal work on intuitive decision making (Benner 1984). Based on the Dreyfus brothers' 5-stage model of skill acquisition, Benner described RNs' potential development. Before becoming an expert, the RN must go through four stages: novice, advanced beginner, competent, and proficient. The novices, with limited experience, must depend on context-free rules (i.e. analytical thinking) to guide their decision making, as opposed to the expert nurses who use intuition to make decisions (Benner 1984, Benner et al. 1996).

In 2000, Cone developed the Triage Decision Making Inventory (TDMI). The author found that the instrument could detect differences between beginner (< 5 years) and expert (> 5 years) ED RNs decision-making processes. However, Ferrario (2001) investigated 173 experienced (> 5 years) and 46 less experienced (< 5 years) triage nurses use of the four types of representativeness heuristic[3], and found that experienced triage nurses used only one of the four representativeness heuristics (judging by perceived causal system) more than less experienced nurses. Dello Stritto (2005) reported that intuition is part of the decision-making strategies used by nurses during ED triage.

However, when investigating triage nurses' ability to accurately allocate acuity ratings, no statistically significant correlations have been reported between clinical experience and accuracy. Both Jelinek and Little (1996) and Considine and co-authors (2000) found no evidence that triage nurses' clinical experience significantly influenced the outcome of their triage.

The Cognitive Continuum Theory (Hamm 1988) suggests that decision making is neither purely analytical nor purely intuitive, but located somewhere in between on the continuum. The cognitive continuum contains six modes of cognition, ranging from analytical (mode 1) to intuitive (mode 6). Moreover, it is assumed that the nature of the decision task elicits a particular mode of cognition that the decision maker uses. The accuracy of decision making partly depends on whether the decision-maker uses the appropriate mode. There are three factors that determine the most appropriate mode: the complexity of the task (e.g., number of cues), the ambiguity of the task content (e.g., familiarity of the task) and the form of task presentation (e.g., time available) (Hamm 1988, Thompson 1999).

Several ED triage studies report that RNs' decision-making processes are influenced by factors that relate to RNs (individual factors) and contextual factors (Gerdtz 2003, Fry 2004, Dello Stritto 2005, Andersson et al. 2006). Gerdtz (2003) found four problems associated with decision making during triage: knowledge-base, time, conflict, and resources. Fry (2004) also found that central to the decision-making process was the element of time: to gather information quickly and to make a decision rapidly. In addition, RNs used a variety of methods when making their decision, including past experience and patients' physiological signs. Dello Stritto (2005) concludes that triage nurses' decision making is affected by the volume of patients waiting to be triaged, fear of missing a serious condition, and having a "gut feeling" about a patient's condition. Finally, in a recent study from Sweden (Andersson et al. 2006) it was concluded that the triage nurses' internal (skills and personal capacity) and external (work environment) factors, in combination with assessment, are the foundation for the acuity rating.

In summary, triage researchers have shown that several factors, both individual and contextual, influence decision making during triage. But what kinds of knowledge, clinical experience, or decision-making strategies that characterise an expert nurse in ED triage remain to be answered.

Rationale for the study

Given the likelihood of increased ED visits, increased co-morbidity among ED visitors, the publics' expectations, and demands, for safe ED care, ED triage is an important part of modern ED care. Whether Swedish EDs are prepared for this increased demand is not known. However, few Swedish studies have been published on this topic. Thus, it is plausible to suggest that few EDs have organised their triage organisation based on the past two decades of internationally conducted research.

Briefly, the previous literature reviews have shown that several 5-level triage scales have been developed and tested for validity and reliability throughout the world. In Sweden, however, no such scales could be identified during the literature review. This apparent lack of valid and reliable triage scales represents a large threat to patient safety. Although the role of the triage nurse has been investigated in the North American and Australian contexts, little is known about this complex task from a Swedish perspective. Moreover, studies aiming to understand the complexity of triage decision making have not revealed what characterises an expert ED triage nurse.

Aims

The overall aim of this dissertation was to investigate RN-led ED triage. The dissertation consists of four papers, one from an organisational perspective and three from the perspective of emergency nurses' triage performance. More specifically, the aims were to describe the Swedish ED triage context and to describe and compare RNs' allocation of acuity ratings and their decision making during the triage process. The specific objectives for the included papers (I-IV) were as follows:

- To describe how triage-related work was organized and performed in Swedish EDs (paper I)
- To describe and compare the accuracy and concordance of RNs' acuity ratings of patient scenarios in the ED setting (paper II)
- To identify relationships between RNs' accuracy in acuity ratings of patient scenarios and their personal characteristics (paper III)
- To describe and compare RNs' use of thinking strategies and the way they structure the ED triage process (paper IV)

Material and Methods

Design

Multiple (including quantitative and qualitative) methods and designs have been used in this dissertation (Table 2). The use of mixed methods was guided by the fact that neither quantitative nor qualitative methods alone were sufficient to address the research questions (Creswell et al. 2004). In addition, the collected data were used in an exploratory way, meaning that the qualitative data from the research project helped to explain the quantitative data, as suggested by Creswell and co-authors (2004).

A literature review conducted during the initial phase of the research project failed to identify ED triage studies from a Swedish perspective and therefore a descriptive design was used in all four papers. In addition, papers II-IV had comparative designs, whereas paper III had both a comparative and a correlative design (Brink and Wood 1998).

Table 2. Overview of the four papers in the dissertation

Paper	Design	Participants	Data collection	Data analysis
I	Descriptive national survey	69 nurse managers or proxies in hospital-based EDs (n=69) serving somatically ill and injured adults	Structured telephone interviews	Descriptive statistics: -Frequencies (number and percent)
II	Descriptive Comparative	423 RNs from 48 hospital-based EDs serving somatically ill and injured adults	Patient scenarios Study related questions	Descriptive statistics: -Frequencies (number, percent, mean, and range) -Cohen's kappa
III	Descriptive Comparative Correlative	423 RNs from 48 hospital-based EDs serving somatically ill and injured adults	Patient scenarios Study related questions	Descriptive statistics: -Frequencies (number, percent, mean, range, and SD) Inference statistics: -Pearson's correlation coefficient -95% confidence intervals -ANOVA
IV	Descriptive Comparative	16 RNs from 13 hospital-based EDs serving somatically ill and injured adults (based on the sample in papers II and III)	Patient scenarios Think aloud	Qualitative content analysis

Setting

In Sweden, EDs are organised based on medical specialities available at the hospitals, and not by acuity level. Within each section of the ED (e.g., medical and surgical), patients with acuity ratings ranging from high to low acuity are treated, which means that the RN in each section is responsible for all patients in the section, regardless of acuity level. Few EDs are staffed with emergency physicians; the most common organisation is the use of physicians from various specialities that are scheduled to the ED on an on-call basis. From an educational perspective, emergency nursing does not exist as a nursing speciality, and in Sweden, no such education is planned in the near future.

Subject selection

The selection of subjects is illustrated in Table 3. At the time of the first data collection, 79 hospital-based EDs operated in Sweden (HSI 2001). Eligible RNs in papers II and III were those routinely performing triage in 78 EDs[4]. In papers I-III, all EDs were invited to participate. In paper IV, which aimed to investigate certain RNs' triage decisions, selection was based on the RNs that participated in the data collection in papers II and III.

Several reasons were given for non-participation (Table 3). In papers II and III, the nurse managers or ED directors presented the reasons for non-participation. Geographical and institutional characteristics of participating hospitals in papers I-III are shown in Table 3. Because of the limited number of hospitals included in paper IV (n=13), type of hospital and geographical location are not reported with respect to ethical considerations.

Table 3. Selection process of subjects in papers I-IV

Paper	I	II and III	IV
Eligible subjects	79 nurse managers or proxies in hospital-based EDs serving somatically ill and injured adults	RNs in 78 hospital-based EDs serving somatically ill and injured adults	23 RNs with previous participation in papers II and III
Withdrawn	10 (shortage of staff, lack of time, participation not approved, difficulty finding suitable personnel, being an out-patient clinic, no reason given)	30 EDs (lack of time and staffing or organisational turbulence)	7 (personal matters)
Participants	69 nurse managers or their proxies	423 RNs	16 RNs
Type of hospital	University: 6 Regional: 4 County: 21 Local: 38 Total: 69	University: 7 Regional: 2 County: 17 Local: 22 Total: 48	Total: 13
Regional location	The district of Götaland: 33 The district of Svealand: 25 The district of Norrland: 11	The district of Götaland: 25 The district of Svealand: 14 The district of Norrland: 9	

Subjects

Participants in the project were nurse managers or their proxies (paper I: n=69) and RNs (papers II and III: n=423 and paper IV: n=16) (Table 3). The aforementioned participants were chosen based on their suitability for the task (paper I) or because they routinely performed triage (papers II and III). In paper IV, the subjects were chosen based on the RNs level of triage accuracy in paper III. Hence, participants in papers I and IV were selected using a purposeful sample (identified by the research team), whereas in papers II and III participants were selected by convenience. In papers II and III, local data collectors, identified by the nurse manager at each of the 48 EDs, were responsible for obtaining the sample.

Instruments

Multiple data collection instruments (interview guide, patient scenarios, and study specific questions) were used. Because no suitable instruments for data collection were available at the time of the project, all the instruments used were designed by the members of the research team. The instruments were inspired by the research team's clinical experience of ED work while the design and content were mainly guided by several ED triage studies in the literature (e.g., Purnell 1991, Considine et al. 2000).

The content of the structured interview guide developed for paper I was informed by studies by Purnell (1991), Geraci and Geraci (1994) and Palmquist and Lindell (2000). The interview guide was made up of 36 items, divided into four components, focusing on hospital demographics (5 items), personnel working in the ED (19 items), knowledge of triage guidelines and legislation and decision support (7 items), and triage scales (5 items). The majority of the items were closed-ended questions but with the possibility for additional comments.

In papers II and III, study specific questions and patient scenarios were used. The study specific questions, addressed to the local data collectors, contained the following sections: ED personnel (2 items), sampling process of participating RNs (1 item), procedure for data collection performed by the RNs (4 items), triage education (2 items), and requirements of RNs who triage ED patients (2 items).

Figure 2 illustrates one of the 40 patient scenarios used. Each scenario consisted of an initial section describing the patient's gender, age, and appearance, followed by a section depicting the patients' chief complaints and how they perceived their condition when encountering the triage nurse. Each scenario was concluded by a section identifying vital signs followed by a space where the participants were to allocate their acuity rating using CTAS.

A 65-year-old male with stomach and back pain arrives to the ED accompanied by his wife. The man states that, except for a previous history of stomach problems related to constipation, he is healthy and takes no medication. His chief complaint is intense pain in the left region of his stomach, with the pain tending to migrate towards the back. The symptom has been present for a few hours upon his arrival to the ED. When the pain first appeared, the man fainted, presumably because of the intense pain. His wife informs the RN that she had to drive to the ED herself because her husband did not have the strength to do it himself.

The man's vital signs are as follow:
Heart rate: 110, blood pressure: 100/70, saturation: 99%, temperature: 37.5°C, skin: a somewhat pale facial colour; no signs of cyanosis.

Figure 2. Example of one patient scenario used in papers II and III

The patient scenarios were followed by a section containing 11 questions addressing the RNs. These questions focused on personal characteristics of the RNs (age, gender, education; non-nursing/nursing/triage specific, and clinical experience; nursing in general; and emergency nursing).

The study specific questions, which were developed based on the results of paper I, were addressed to the local data collectors. The scenarios were developed by the research team and one additional RN, and were based on literature review (Considine et al. 2000), as well as the group's expertise in ED care and scenario design. The patient scenarios covered internal medicine, surgical, neurological, infectious, ear/nose/throat, orthopaedic, and paediatric cases. The study specific questions addressed to the RNs were informed by a previous literature review (Gerdtz and Bucknall 2001).

Patient scenarios were also used in paper IV (Figure 3). Each patient scenario contained text describing the overall appearance and chief complaint of patients arriving at the ED and requiring initial triage by an RN. In contrast to the patient scenarios in the previous papers, the RNs in paper IV were not to allocate an acuity rating, but rather to think aloud as they reasoned about their thoughts and actions.

> A man comes walking to the ED. The man, who seems to be of middle-age (about 45 years), enters the ED alone. He moves without any problems and does not use a walking aid. He sits down on the chair in front of you, without any apparent problems. The only noticeable thing with the man is his facial colour: he looks warm and has red cheeks. When asked what his chief complaint is, the man states that he has soar muscles and a fever for the past two days. He coughs when telling you this.

FIGURE 3. Example of one patient scenario used in paper IV

The five scenarios used in paper IV were developed by the research team, which includes an RN with extensive knowledge and use of patient scenarios. They were based on authentic patient situations and constructed to be suitable for the purpose of the paper, i.e. to stimulate decision making while still remaining credible as real-life triage situations.

Data collection

Three data collections were performed in 2002 (paper I), 2003-2004 (papers II and III), and 2004-2005 (paper IV) using the following methods: telephone interviews, patient scenarios, study specific questions and think aloud (TA) method. In paper I, nurse managers or their proxies were contacted by mail to inform them about the study and to arrange time for a telephone interview. On an agreed upon date, KG phoned the participating subject and carried out the interviews, which lasted between 20 and 35 minutes.

Local data collectors gathered data in papers II and III during a one- or two-day period. If data were collected during a two-day period, instructions were given to choose, if possible, two shifts relieving each other. This was done in order to minimise the participants' possibility to communicate with one another about the patient scenarios. Data collection was initiated by a session of information provided by the local data collectors. Immediately after this session, each RN received the data collection set. The local data collectors supervised the entire data collection process, which took approximately 60 minutes. After gathering all data and answering the study specific questions, the local data collectors mailed the material in sealed envelopes to KG.

Following the steps described by Fonteyn and co-authors (1993), the data of paper IV were gathered using TA method (Ericsson and Simon 1993). One session was conducted in the subject's home while the rest were conducted in a quiet place at the RNs' workplace. Before starting the TA session, the RNs were given some examples for the purpose of practice in order to make sure that they felt confident with the method. After the test session, questions and thoughts about the method were discussed before initiating data collection. Moreover, participants were told to act as if they were working in the ED and that the fictitious patients were actual patients in front of them at their workplace. Data collection began by approaching the RN with the first of five patient scenarios, which was read aloud by the RN, followed by thinking aloud while starting to reason. If the RN was silent for more than a few seconds, he or she was prompted to continue to think aloud. Participants undertook all five scenarios before a follow-up interview was conducted. The entire process, which took approximately 60 minutes, was audio-taped.

Data analysis

Quantitative data from papers I-III were analysed by statistical methods using the computer software SPSS Version 11.0, 12.0 and Microsoft Excel, whereas data from paper IV were analysed by qualitative content analysis. The software QSR NVivo was used to facilitate content analysis of the data.

The statistical analyses are illustrated in Table 2. Descriptive statistics were used to various degrees in all the quantitative papers. To calculate the RNs' accuracy in acuity ratings in paper II Cohen's kappa (κ) was performed. The inference statistics (Pearson's correlation coefficient) used in paper III were conducted to investigate correlations between accuracy in acuity ratings and personal characteristics and to determine differences between groups (95% confidence intervals for two groups and ANOVA for three groups). Parametric analyses were conducted based on the data level (continuous) (Altman 1991).

The qualitative content analysis was done in several steps. The first step was to read all verbal protocols as a whole in order to become familiar with the data and to gain an overall impression of the text. The next step involved performing a deductive content analysis based on the thinking strategies described by Fonteyn (Table 4) that, in turn, were based on studies in several nursing fields, including emergency settings (Fonteyn 1998).

Following the identification of thinking strategies, the third step consisted of establishing a profile[5] for each RN by reading his or her transcript. In the final phase of analysis, step four, comparisons of the RNs' use of thinking strategies and profiles were made by dividing the verbal protocols from the RNs into two groups based on the RNs' triage accuracy in paper III.

TABLE 4. Thinking strategies used during deductive analysis in paper IV (From Fonteyn 1998)

Thinking strategy	Definition
Recognising a pattern	*Identifying characteristic pieces of data that fit together*
Setting priorities	*Ordering concepts in terms of importance or urgency*
Searching for information	*Mentally looking for missing or concealed information*
Generating hypotheses	*Asserting tentative explanations that account for a set of facts*
Making predictions	*Declaring in advanced*
Forming relationships	*Connecting information to further understanding*
Stating a proposition	*Stating a rule governed by if-then*
Asserting a practice rule	*Asserting a truism that has been shown to consistently hold true in practice*
Making choices	*Selecting from a number of possible alternatives, to decide on and pick out*
Judging the value	*Forming an opinion about worth in terms of usefulness, significance , or importance*
Drawing conclusions	*Reaching a decision or forming an opinion*
Providing explanations	*Offering reasons for actions, beliefs, or remarks*
Pondering	*Mentally pausing to reflect on the meaning of a piece of information*
Posing a question	*Asking for answers without really expecting to receive them*
Making assumptions	*Taking for granted or supposing*
Qualifying	*Modifying, limiting, or restricting, as by given exceptions*
Making generalizations	*Inferring from many particulars*

Methodological considerations

The interview guide in paper I was piloted twice, resulting in several revisions. Because of the preconception of unfamiliarity of the word triage among the participants, a concept clarification was conducted (Brink and Wood 1998). This resulted in triage being replaced by "assessing and prioritising patients". The concept triage was sparsely used in the interview guide.

As suggested by Brink and Wood (1998), the patient scenarios in papers II and III were piloted before conducting data collection. During the pilot study, the 40 patient scenarios were triaged by a test group consisting of four RNs and one physician from the same ED. The choice of the four RNs and one physician was partly because of their long experience of ED care, partly because of their interest in the study, partly because they were believed to be able to evaluate the scenarios in a constructive way, and partly because they had the ability to reason about their acuity ratings and thus contribute to valid and realistic patient scenarios.

The pilot study resulted in minor revisions to the patient scenarios. After completing the revisions, data collection was initiated. However, when conducting an inter-rater reliability test (based on the acuity ratings allocated by

the developers and the test group) of the 40 scenarios, only 18 scenarios showed an inter-rater reliability level of 80% or higher. Consequently, an expected acuity rating was identified for each of these 18 patient scenarios based on the acuity rating agreement of 80% or higher between the developers and the test group. The result from the inter-rater reliability test led to only 18 patient scenarios being used for analysis, of which there were five level 1 scenarios, five level 5 scenarios, three level 2 scenarios, three level 4 scenarios, and two level 3 scenarios.

In paper II, the 18 patient scenarios were placed into three sub-groups according to medical speciality: 7 non-surgical scenarios (internal medicine, ear/nose/throat, infection, and neurological), 10 surgical scenarios (surgical and orthopaedic), and one paediatric scenario[6]. In paper III, categorising the RNs into high and low accuracy groups was made on the natural distribution of the RNs' accurate acuity ratings (Figure 4).

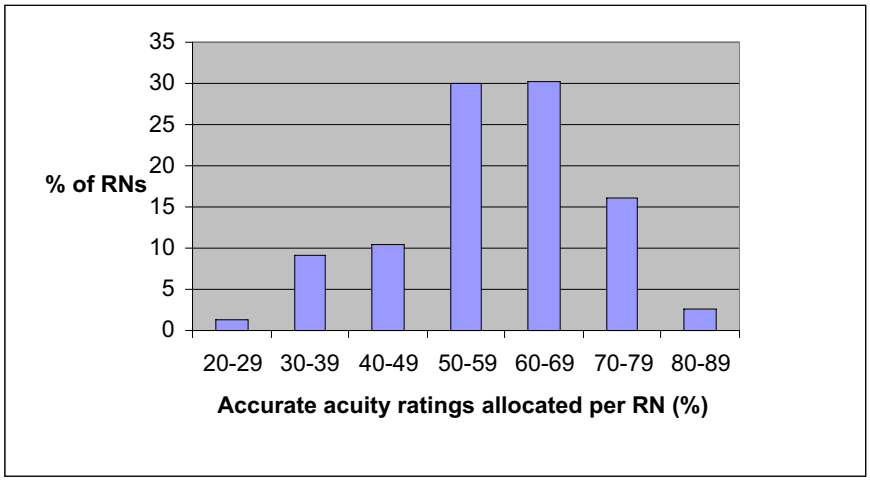

FIGURE 4. Distribution of RNs' accurate acuity ratings (n=423)

The CTAS was used in papers II and III. As mentioned previously, it is a 5-level triage scale in which each acuity level indicates the estimated waiting time for a patient seeking emergency care. In the two papers in which the CTAS was used, only the time frames were shown on the data collection set. The main reason for not using the suggested sentinel diagnoses and presentations in the CTAS is that such diagnoses and presentations may be

dependent on local variations (Canadian Association of Emergency Physicians and National Emergency Nurses Affiliation of Canada 1998).

One of the main reasons for calculating both weighted and unweighted κ statistics in paper II is the lack of consensus in the ED research community regarding which of the two κ methods to use (Fan et al. 2004, Grafstein 2004, Fernandes et al. 2005). Furthermore, by using both methods, comparison with other studies to a larger extent is facilitated. Finally, the two methods treat disagreements differently, with unweighted κ treating all disagreements equally, whereas weighted κ takes into account the degree of disagreement, which normally yields higher values than the unweighted κ (Altman 1991). In paper II, concordance of the RNs acuity ratings was also calculated. The reason for this calculation was to enable analysis of RNs acuity ratings, not only in relation to the expected acuity rating but also in comparison with each other.

As suggested by Fonteyn and co-authors (1993), the patient scenarios, as those in paper IV, were validated for realism and relevance: in this case by a panel of three RNs with extensive ED experience. Three pilot interviews were also conducted before data collection, resulting in changes with reference to type of information presented in the scenarios. In addition, another three interviews (the first three interviews conducted in the main study) also served as pilot interviews. After analysis of these three interviews, the verbal instructions given to the participants during data collection were slightly altered, resulting in a richer set of data.

The scenarios in paper IV were not presented in segments as suggested by Fonteyn and co-authors (1993). By providing information in several steps, it is believed to resemble more closely real-life situations (Fonteyn et al. 1993). The main reason for not using segmented information in this study was that generally there is limited information provided in the triage situation. Thus, segmenting this limited information would result in a very small amount of information in each segment. Furthermore, during the developmental phase of the patient scenarios, such a design was tested, but with unsatisfactory results.

In order to prevent bias during deductive analysis, the researchers were blinded regarding the RNs' competence in triage accuracy. It was not until the comparative phase of the analysis that the RNs' triage accuracy was known to the researchers. To strengthen credibility in the analysis 15 (19%) TA protocols were analysed individually by the co-researchers, compared, and discussed until agreement was reached.

In this research project an expected acuity rating refers to the acuity rating allocated by the developers for each of the 18 patient scenarios; modal acuity rating refers to the most frequently chosen acuity rating for one scenario by the RNs. Accuracy is understood as the ability to target the expected acuity rating while concordance refers to agreement between the RNs' ratings (The New Penguin Compact English Dictionary 2001). P-values were considered statistically significant if $p<0.05$. Interpretation of the κ values was based on the definitions reported by Altman (1991, p. 404), suggesting the following guidelines: < 0.20: poor, 0.21-0.40: fair, 0.41-0.60: moderate, 0.61-0.80: good, and 0.81-1.00: very good.

Ethical considerations

The studies were all approved by the Örebro University Ethics Committee (Dnrs: CF 18-2003 and CF 2003/296). The medical directors at the participating EDs gave written permission for conducting the studies at their ED, and the nurse managers were informed about the studies being conducted before the start of data collection. In all studies, participants received written and verbal information about confidentiality and the voluntary nature of their participation, including the right to decline participation or withdraw at any time.

Results

The overall results from this research project show that Swedish ED triage varies substantially, both in the way it was organised and in the way it was conducted. From an organisational perspective, the variation was notable in many areas, such as the triageur and triage scales. Variation was also evident in the allocation of acuity ratings, where both accuracy and concordance of acuity ratings varied. Only limited explanations to account for the variation in allocation of acuity ratings emerged from the statistical analyses. The triage nurses used multiple thinking strategies and structured the triage process in several ways. However, comparison of RNs' use of thinking strategies and the structure of the triage process based on their previous triage accuracy showed only slight differences.

Organisational perspective (Paper I)

Paper I revealed that 69 (87%) of the participating EDs used designated triage nurses and triage scales to various extents. It was found that triage was carried out by various triageurs, with greater variation for non-ambulance-arriving than ambulance-arriving patients. The paper also revealed that knowledge about triage guidelines and legislation deviated among the nurse managers. Participating hospitals by type and geographic location are shown in Table 3.

The triageur

Designated triage nurses

Twenty-four (35%) EDs used a designated[7] triage nurse to perform triage (Table 5). The only general hospital that participated used designated triage nurses; regional hospitals also used designated triage nurses to a large extent. Local hospitals, however, employed designated triage nurses to the least extent.

TABLE 5. Type of hospital and the use of designated triage nurses (n=24)

	Type of hospital					
	University	Regional	County	Local	General	Total
	n (%)	n (%)	n (%)	n (%)	n (%)	n
Designated triage nurse	3 (50)	3 (75)	12 (57)	5 (13)	1 (100)	24

Designated triage nurses were on duty 24 hours a day in 14 of the 24 EDs. Of the remaining 10 EDs, eight provided a designated triage nurse during

day and evening shifts, one during evening and night shifts and one during evening shifts. All 24 EDs provided designated triage nurses for non-ambulance-arriving patients and 7 EDs also had this service for ambulance-arriving patients. Finally, 16 of the 24 EDs provided rooms specifically intended for triage, whereas the remaining 8 EDs used any available area in the ED.

The majority (60%) of the 45 EDs that did not employ designated triage nurses justified their practice by the fact that they had never used such RNs and thus saw no need to change their routine.

Non-ambulance-arriving patients

In 56 of the 69 EDs triage began in the reception area. Clerical staff, an LPN (licensed practical nurse), or RN decided whether the patient was to be sent to the waiting or to the treatment area. All these patients, regardless of whether they went to the waiting or the treatment area, were formally triaged by the RN in the treatment area. In seven (10%) EDs patients went from reception to the treatment RN for triage and six (8.7%) EDs had their patients walk straight to the treatment RN or designated triage nurse for triage.

Ambulance-arriving patients

Patients arriving by ambulance were triaged by an RN in 68 (99%) of the 69 EDs; in the remaining ED either an RN or LPN performed triage. In five of the seven EDs employing a designated triage nurse for ambulance-arriving patients, such RN was on duty 24 hours a day. In the remaining two EDs with designated triage nurses for ambulance-arriving patients, the treatment nurse on duty in the ED performed triage during hours when the designated triage nurse was not on duty.

Triage scales

The use and design of triage scales differed across Sweden. Totally, 37 (54%) EDs used a triage scale, though the design of these triage scales varied immensely. Of these 37 scales, 15 were designed without a time frame and 16 triage scales were used in only one ED each. A total of 18 EDs used a 3-level triage scale, 15 EDs used a 4-level triage scale, and 4 EDs used a 5-level triage scale (Table 6). Common for all scales was that level one indicated the most urgent level, which means that patients who were triaged to level one were to be assessed by a physician immediately. Remaining triage levels varied considerably regarding the time frame used in association with each level.

Four EDs that used designated triage nurses did not use a triage scale, whereas 17 EDs without designated triage nurses used a triage scale.

Table 6. Triage scales used in Swedish emergency departments (n=37)

	Time frame for treatment in minutes		
	3 levels	4 levels	5 levels
	n = 18	n = 15	n = 4
Level 1	Immediate	Immediate	Immediate
Level 2	15-120 minutes	15- 60 minutes	30- 60 minutes
	(No time limit)	(No time limit)	
Level 3	180 minutes	60- 180 minutes, 24 hours	60- 120 minutes, 6 hours
	(No time limit)	(No time limit)	
Level 4		120 minutes, 12 hours	120 minutes, 24 hours
		(No time limit)	(No time limit)
Level 5			3 days
			(No time limit)

A numeric triage scale was used by 32 of the 37 EDs. The remaining EDs used a colour-based scale (2 EDs), text-based (1 ED), text- and colour-based (1 ED) or a numeric scale in combination with text (1 ED). Of the 32 EDs that did not use a triage scale, 18 referred to their working tradition as the reason for not using this type of tool. The remaining 14 EDs argued that the limited number of visits made to the ED made it possible to triage without a triage scale or that the staff organised the patient records in such a way that a systematic rating was conducted.

Knowledge about triage guidelines and legislation

The majority (77%) of the nurse managers were not aware of any national documents (standards, guidelines, or legislation) for ED triage. However, seven (10%) participants claimed to know of such national documents while five (7%) reported knowledge of local documents.

RNs' acuity ratings (Papers II and III)

The results in papers II and III showed that the RNs' agreement with the expected acuity ratings was low. In addition, the RNs inter-agreement in acuity ratings varied, where more than half (56%) of the patient scenarios were triaged over all five triage levels. However, these variations could only to a limited extent be explained from the statistical analyses, suggesting that,

to some extent, nursing experience may influence the ability to accurately triage patient scenarios.

Accuracy

Of the 7550 acuity ratings allocated on the 18 patient scenarios, 4357 (57.7%) were accurate (i.e. in agreement with the expected acuity rating), whereas 3193 (42.3%) were inaccurate. Thus, the inter-rater agreement was 0.46 (unweighted κ) and 0.71 (weighted κ). Of the 3193 inaccurate acuity ratings, 2144 (67.2%) were overtriaged[8] and 1049 (32.8%) were undertriaged[9].

Expected and allocated acuity ratings are presented in Table 7. The largest number of accurate acuity ratings per triage level was allocated to levels 1 (85.4%) and 5 (65.1%). Patient scenarios with expected acuity ratings of levels 2, 3, and 4 were accurately triaged in 39.5%, 34.9%, and 32.1%, respectively. Overtriage was more common for levels 2 and 4 scenarios, whereas level 3 scenarios were evenly accurate (34.9%), overtriaged (32.3%), and undertriaged (32.8%).

Table 7. Distribution of expected and allocated acuity ratings (n=7550)

		Expected acuity ratings					
Allocated acuity ratings	Time to physician (in minutes)	Level 1 (n)	Level 2 (n)	Level 3 (n)	Level 4 (n)	Level 5 (n)	Total (n)
Level 1	Immediate	*1791	460	59	37	3	2350
Level 2	Within 15	259	493	211	189	25	1177
Level 3	Within 30	45	231	292	453	144	1165
Level 4	Within 60	3	58	241	403	565	1270
Level 5	Within 120	0	7	33	175	1373	1588
Total		2098	1249	836	1257	2110	7550

*Shadowed cells indicate agreement in allocated acuity ratings.

Nearly all (94.6%) of the RNs overtriaged the scenarios while fewer (79.7%) RNs undertriaged. The mean overtriaged and undertriaged patient scenarios per RN was five (SD 3.1) and two (SD 2.2), respectively. Further, the mean of accurately triaged patient scenarios per RN was 58% (SD 12.8).

As Figure 4 depicts, the range of accurately triaged patient scenarios per RN varied from 22% to 89%. Moreover, 79 (18.7%) of the RNs accurately triaged more than 70% of the patient scenarios, with a mean of 75.2% (SD

0.04) accurate acuity ratings per RN. Totally, 89 (21%) RNs triaged less than 49% of the scenarios accurately, with a mean of 39.2% (SD 0.06) accurate acuity ratings per RN. A significant difference was observed regarding accurately triaged scenarios per group (CI for differences 0.22-0.50). The majority (60.3%) of RNs accurately triaged 50-69% of the patient scenarios.

Figure 5 illustrates the allocation of accurate acuity ratings as a function of the 79 (18.7%) RNs with high (>70%) accuracy and the 89 (21%) RNs with low (<49%) accuracy. As can be seen in the figure, there were differences between the two groups on all five triage levels. The RNs with high accuracy allocated accurate acuity ratings in a similar way as the entire sample, i.e. levels 1 and 5 patient scenarios have the highest rate of accurate allocations. However, the RNs with low accuracy allocated accurate acuity ratings mainly to level 1 scenarios (scenarios with highest acuity).

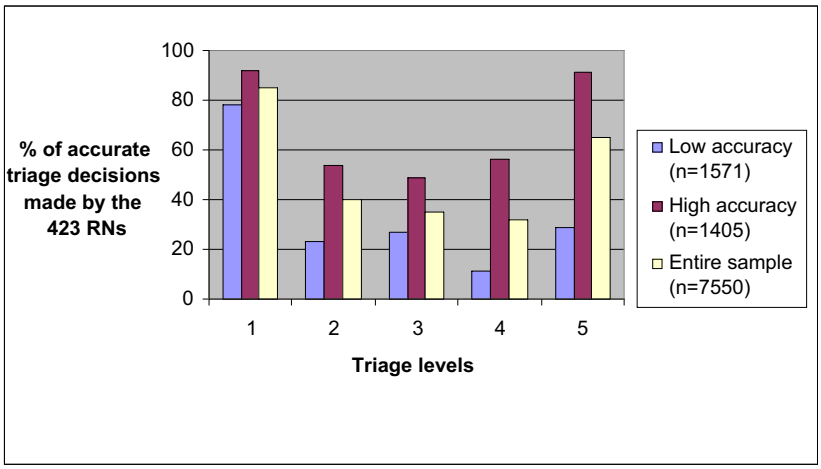

FIGURE 5. RNs' allocation of accurate acuity ratings displayed by high or low triage accuracy

The 423 RNs' allocation of accurate acuity ratings, as based on the medical speciality of the patient scenarios, is summarised in Table 8. Totally, 1769 (60.3%) acuity ratings were accurately allocated to the non-surgical scenarios while 2267 (54%) of the allocated acuity ratings to the surgical scena-

rios were accurate. The only paediatric scenario, a level one scenario, had the highest allocation of accurate acuity ratings (76.3%).

TABLE 8. Distribution of the acuity ratings allocated by the RNs by medical speciality (n=7550)

Medical speciality	Patient scenarios no.	Expected triage categories	Triage ratings no.	Expected (%)	Overtriage (%)	Undertriage (%)	Total (%)
Non-surgical	7	1, 2, 4, 5	2934	60.3	30.5	9.2	100
Surgical	10	1-5	4198	54	29.8	16.2	100
Paediatric	1	1	418	76.3	0	23.7	100
Total	18		7550				100

Concordance

The modal acuity rating (the most frequent chosen acuity rating for one scenario) was the same as the expected acuity rating in 13 (72%) patient scenarios. For four of the remaining scenarios, the modal acuity rating resulted in overtriage. For none of the level 3 scenarios was the modal acuity rating in concordance with the expected acuity rating. RNs that triaged the patient scenarios in agreement with the modal acuity rating varied from 34.4 to 92.7%, where level 1 and 5 scenarios had the highest rates (58.5-92.7% and 55.1-85.3%, respectively).

Furthermore, the RNs' acuity ratings resulted in 10 (56%) patient scenarios being triaged across five levels, four (22%) scenarios across four adjacent levels and another four (22%) scenarios across three adjacent levels. Not one scenario was triaged into one or two adjacent triage levels by all RNs, with the smallest diversion occurring among level 1 scenarios that were triaged across 3-4 levels. The remaining patient scenarios (i.e. levels 2-5 scenarios) were triaged across all five triage levels. However, levels 2 and 5 scenarios were triaged across four levels by 99.4% and 99.9% of the RNs, respectively.

Relationship between accurate acuity ratings and personal characteristics

The relationship between the 423 RNs' ability to allocate accurate acuity ratings with their personal characteristics (triage education, type of hospital currently working in, and general and ED nursing experience) is listed in Table 9. The only significant relationship with triage accuracy was years of

clinical experience as a nurse in an ED and as a nurse in general practice. However, there was no significant relationship between clinical experience (general and ED nursing), when dichotomised to shorter (< 5 years) and longer (> 5 years) experience, and accuracy in acuity ratings.

TABLE 9. Relationship between RNs' personal characteristics and their triage accuracy

Personal characteristics of RNs (n = 423)	Triage accuracy	
	% (SD)	
Triage education	57.6% (12.5)	
No triage education	57.7% (12.8)	-0.12-0.12[a, e]
Type of hospital		F = 2.963, p>0.05[b, d]
General nursing experience		r = .151, p=0.002[c]
> 5 years	58.5% (12.3)	
< 5 years	56.3% (13.6)	-0.08-0.12
ED nursing experience		r = .131, p=0.008[c]
> 5 years	58.5% (12.8)	
< 5 years	57.3% (12.8)	-0.08-0.11

[a] Confidence interval for difference (95%).

[b] ANOVA.

[c] Pearson's correlation coefficient.

[d] 1 missing data.

[e] 4 missing data.

The personal characteristics of the RNs as a function of high and low accuracy are given in Table 10. There was homogeneity in age, general nursing experience, and triage education, but the RNs with high accuracy in the allocation of acuity ratings had longer ED experience.

Table 10. Personal characteristics of RNs with high (n=79) and low (n=89) accuracy in the allocation of acuity ratings

	Age	Nursing experience		Triage education
	Years (SD, range)	Years (SD, range)		n
		General	ED	
High accuracy	41 (10.4, 24-63)	14 (10.9, 0.4-40)	9 (8.6, 0.2-33)	18[a]
Low accuracy	41 (10.2, 23-64)[a]	11 (8.4, 0.5-37)[b]	7 (7.1, 0-35)[b]	18[a]
Confidence interval (95%) Difference between means	-0.15 – 0.15	-0.07 – 0.13	0.08 – 0.32	

[a] 1 missing data

[b] 4 missing data

Triage decision making (Paper IV)

In the last paper (IV), the RNs' decision-making processes during triage were investigated in order to gain a deeper understanding of some of the differences in allocation of acuity ratings. Although the results showed that several thinking strategies were used by the RNs, and the profiles showed that the RNs structured the triage process in several ways, a comparison of RNs' use of thinking strategies and the structure of triage process as a function of triage accuracy showed only small differences.

Demographics

The demographics between the two groups of RNs were similar, with ages ranging from 25-58 years, and where women and men were represented in both groups. In the high triage accuracy group the RNs' general nursing experience ranged from 0.80 to 34 years, with a mean of 15.5 years (SD 9.7); the ED nursing experience in this group was from 0.80 to 26 years, with a mean of 10.6 years (SD 9.7). In the low triage accuracy group the RNs' general nursing experience ranged from 0.50 to 10 years, with a mean of 8.4 years (SD 8.4); the ED nursing experience in this group was from 0.50-10 years, with a mean of 3.9 years (SD 3.2).

Thinking strategies

The RNs used 14 of the 17 thinking strategies described by Fonteyn 1998 when triaging the patient scenarios.

Three kinds of *assertions of practice rules* were carried out: assertions about procedures, assertions relating to informal rules learned by experience, and assertions about policies. Assertions about procedures focused on medical treatment and nursing interventions such as treatment (e.g., elevation of injured limbs), measurement (e.g., collection of vital signs), and allocation of acuity ratings (e.g., treatment area). Assertions relating to informal rules learned by experience concerned symptoms (e.g., the reasoning about whether or not the symptoms relate to a ruptured aorta aneurysm) as expressed in the following quotation: "They don't need to be, it is the ones dissecting that are in pain. This one can be dissecting slowly." One assertion about policies was made about the attitudes of other health professionals toward patients with back problems.

The RNs *generated hypotheses* about possible diagnosis for the problems presented by the fictitious patients, the aetiology of the problems, the fictitious patients' history, the patients' current status, and the patients' special needs.

The RNs also *judged the value* of their findings, which mainly resulted in additional collection of data and allocation of acuity ratings. The RNs *made assumptions* only to a limited extent, and when they did make assumptions, they were primarily concerned with symptoms, signs, and patient abilities. The RNs also *made predictions* regarding actions to be taken (e.g., medical treatments and collection of additional data). However, the RNs made predictions to only a limited extent regarding findings that they expected, as expressed in the following quotation: "Because he is in so much pain, I expect that it is a bit swollen." In addition, the RNs *pondered* over what interventions should be undertaken, the fictitious patients' symptoms, and the difficulty in triaging the patients based on the scenarios. The RNs also *posed questions* aloud to themselves about the patient scenarios, mainly focusing on two aspects: nursing interventions and symptoms.

Making choices pervaded the RNs' triage decision-making process. The RNs made choices about several nursing interventions, including the allocation of acuity ratings, taking administrative actions, asking questions, and making assessments, measurements, and treatments, including medical treatments. It was also common for the RNs to *form relationships* between their chosen actions and the patient symptoms in the scenarios. As indicated by the following quotation, the relationships were based on symptoms and led to intervention or medical treatment: "And if the patient doesn't have pain anywhere else than in the muscles in general, run some tests and maybe check his temperature."

The RNs *provided explanations* for the nursing interventions and medical treatments that they made choices about in their triage decisions. The acuity ratings were allocated based on signs, symptoms, status, predicted interventions, prevention of deterioration, possible diagnoses of the patient scenarios, and in relation to other patients waiting in the ED. The explanations for the choice of administrative actions were mainly that the RNs searched for additional information that was not accessible in the ED. The RNs asked questions based on possible diagnoses, symptoms, signs, and current status. The main explanation provided by the RNs for assessing the fictitious patient was the patient's symptoms; however, additional illnesses were also taken into account, as described or indicated in the scenario. Several explanations were given for choice of measurements, though the two main reasons were based on symptoms and hoping to find some relevant information by conducting various kinds of measurements. The particular treatments

chosen were motivated by prevention, waiting times, and the symptoms reported in the patient scenarios.

The RNs *recognised patterns*, both typical cases and lack of fit[10]. The typical cases were recognised based on the patients' current status and illnesses, age, and diagnoses as described in the scenarios; lack of fit concerned symptoms and diagnoses, as expressed in the following quotation: "But normally that is very painful, so it can't be that."

A great deal of *information was sought* and related to the history as well as to the current situation of the fictitious patient. Information relating to historical aspects covered previous illnesses and medications, as well as social status whereas information relating to the current situation contained information about the duration and onset of the current symptoms, previous experience of the current symptoms, signs, and actions carried out by the patient or accompanying persons.

The RNs *set priorities* based on their concerns for the patients as well as the order to be used in carrying out nursing interventions. The concerns about the patients dealt with history and symptoms, such as that expressed by the following quotation: "…that he says that he has never been in so much pain before." The RNs prioritised all kinds of nursing interventions, except regarding allocation of acuity ratings. Two kinds of *propositions were stated,* namely to choose a plan of action and to determine etiology. The RNs chose their plans of action primarily based on symptoms, which led to several nursing interventions. In addition, possible diagnoses led to nursing interventions, and the accessibility of care facilities influenced reasoning about acuity ratings. In order to determine aetiology the RNs related the symptoms to possible diagnoses.

The three strategies not found in this study were drawing conclusions, qualifying, and making generalizations.

Triage process

The RNs commenced the triage process in three ways (Figure 6). Twelve RNs used the most common way, i.e. to gather more data (profile 1). These RNs moved on to either allocate acuity ratings directly or to generate hypotheses before allocating an acuity rating.

The three RNs who started the triage process by generating hypotheses (profile 2) continued by gathering more data before they allocated acuity ratings. One RN (profile 3) initiated the process by allocating acuity ratings and moved on to generate hypotheses and collect data.

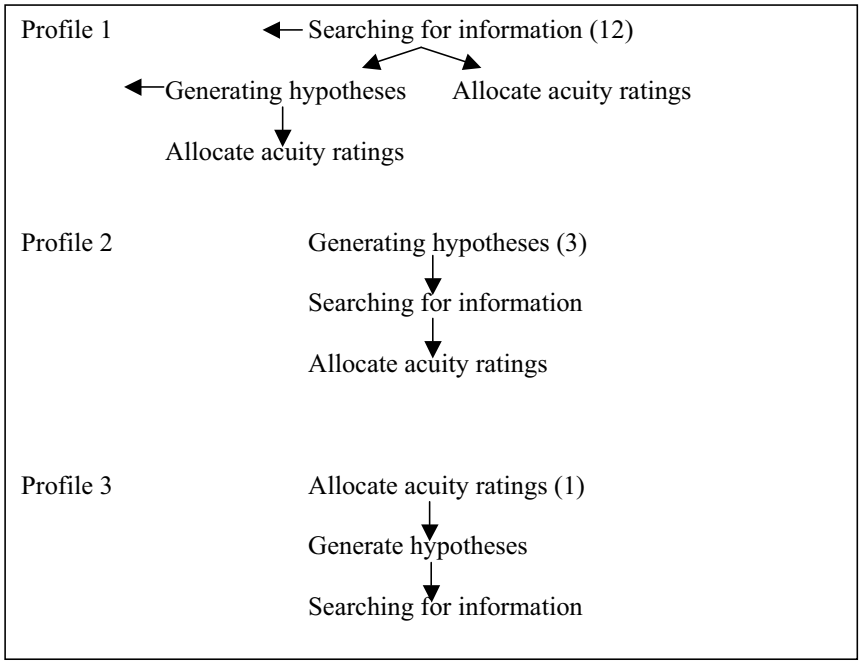

FIGURE 6. The structure of the triage processes used by the RNs (n=16)

Regardless of how the RNs began the triage process, nine RNs moved back and forth during the process (e.g., between data gathering, generating hypotheses, and allocating acuity rating allocation). The remaining seven RNs used a linear approach, i.e. they moved from one step to the next without reverting to an earlier step. The number of hypotheses generated for a patient scenario varied among the participants. Three RNs did not generate hypotheses about possible diagnoses for the fictional patients, whereas two RNs generated seven hypotheses each for one patient scenario. The most common approach was to generate one or two hypotheses for each fictitious patient.

Comparison of RNs' use of thinking strategies and structure of the triage process based on their triage accuracy

The RNs' use of thinking strategies was similar, regardless of their triage accuracy in paper III. However, the RNs with high accuracy made more *assertions about practice rules* than their colleagues with low triage accuracy. The RNs with high accuracy also *generated more hypotheses* regarding pa-

tient status and patient history, and these RNs *made more assumptions* about the fictitious patients. However, more RNs with low triage accuracy *formed relationships* between their actions (interventions and treatments) than the RNs with high triage accuracy, and they *provided more explanations* for their choices of interventions and treatments.

Limited differences were revealed when comparing the RNs' profiles as based on their triage accuracy. The group of RNs with high triage accuracy included the RNs who limited the triage process to data gathering and included the only RN who began the process by making a decision. However, variation occurred within both groups: RNs either moved back and forth, or structured the process in a linear way; furthermore, RNs generated hypotheses about possible diagnoses in similar ways in both groups. The intra-group variations were similar in the two groups and hence no differences in the structure of the thinking strategies were identified between the groups.

Discussion

Reflections on the results

National variation in triage organisation has been reported in both Sweden and the USA (Purnell 1991, Palmquist and Lindell 2000). However, in contrast to Sweden, triage related issues in the USA (e.g., the use of RNs during triage, triage systems, and triage scales) have been discussed in the emergency nursing community during the past decade. Although the development of ED triage has moved forward in many Anglo-Saxon countries, in Sweden it has not been a major topic for discussion or development.

Accuracy in allocation of acuity ratings has not been investigated in Sweden and thus the present results cannot be compared with similar Swedish studies. However, several similar studies have been conducted in other countries, with both lower and higher accuracy as compared with the findings in this thesis (e.g., Beveridge et al. 1999, Manos et al. 2002, Worster et al. 2004). In addition, the present finding that general nursing as well as context-bound nursing experience alone cannot explain the variation in nurses level of triage accuracy is supported by other studies (Considine et al. 2001, Worster et al. 2004).

Although RNs' decision making during ED triage has previously been investigated (Fry 2004, Dello Stritto 2005), comparisons of RNs decision-making processes have mainly been conducted based on the RNs clinical experience, not on triage accuracy (Cone 2000, Ferrario 2001). Therefore, the findings concerning decision making in relation to triage accuracy are difficult to compare with other triage studies.

Organisational perspective (Paper I)

One major advantage of using designated triage nurses is that they can focus on triaging without being interrupted by other duties (e.g., telephone counselling and helping out in the treatment area). Several studies have reported how such additional tasks and interruptions interfere with the triage process, resulting in a longer triage assessment than necessary (Geraci and Geraci 1994, Andersson et al. 2006). Given the negative aspects of not using designated triage nurses, it is particularly disconcerting that only 35% of Swedish EDs used such RNs for conducting triage. This suggests that the majority of Swedish ED RNs (i.e. those that are not designated to triage) are performing other tasks in addition to triage and hence perform triage under non-optimal conditions. Thus, the quality and safety of such triage decisions may be compromised.

In addition, the fact that only two thirds (n=16) of the EDs using designated triage nurses provided appropriate facilities (e.g., specific triage rooms) is of disquiet because it may result in the RNs having to spend critical time finding a room and equipment in addition to attending to the patient. Again, such triage organisations may interfere with RNs' triage work, which might in turn have a negative affect on the quality and safety of the triage decisions.

The use of less qualified triage personnel (clerical staff and LPNs) needs to be examined in future research. Many countries (e.g., Australia) with several years experience of ED triage use RNs for this task (Pardey 2006). As others suggest (Purnell 1991, Gerdtz and Bucknall 2001), ED triage is a complex task that requires knowledge in many areas. It is therefore plausible that RNs that allocate acuity ratings based on the assessment of other personnel may be at high risk of making inaccurate decisions. Nevertheless, it is encouraging that all but one ED used only RNs to triage ambulance-arriving patients.

Local hospitals, in contrast to regional and general hospitals, rarely used designated triage nurses, suggesting that use of designated triage nurses is dependent on factors other than type of hospital. Another reason could be presence of personnel with impassioned spirits at individual EDs that have brought designated triage nurses into the organisation. The absence of designated triage nurses may relate to the fact that local hospitals generally have fewer patients seeking care and therefore managers at these EDs may have lacked the incentive to use designated triage nurses. The lack of forums to discuss triage-related issues in Sweden could also have contributed to the absence of designated triage nurses.

The heterogeneity in the use and design of triage scales is another matter of concern. Not one ED used a triage scale that had been tested for its validity and reliability and nearly half (46%) of the EDs did not use any kind of triage scale. Further, because a triage scale is the instrument for triage nurses to assess and rate acuity, and consequently, length of waiting time, it is fundamental that such an instrument is safe and reliable. Yet, more than 15 years of research indicate that it is challenging to design valid and reliable triage scales. For example, the ESI and the CTAS, two of the most investigated ED triage scales, have recently been revised (Gilboy et al. 2005, Murray et al. 2004).

From a medico-legal aspect, it is important that triage scales are safe and accurate because the RNs' triage decisions are closely linked to these instruments. Furthermore, the use of a standardised regional or national triage scale is essential regarding such issues as overcrowding, ambulance

diversion, and in the event of a terrorist attack. Therefore, it is disquieting that neither the local EDs nor national organisations, such as the National Board of Health and Welfare in Sweden, have paid attention to this issue.

There are no clear reasons for the above-mentioned organisational differences. One possible explanation is the lack of emergency nursing and medicine as specialities in Swedish health care, resulting in a deficiency of clinical and scientific knowledge in this area. As well, issues relating to the complexity of ED triage and the impact of triage accuracy on patient safety have not, until the past couple of years, been on ED RNs agenda in Sweden. Further, because of a lack of research, it is not surprising that several EDs refer to their routine procedure when presenting the rational for their triage organisation. Finally, the lack of national standards and guidelines for triage may also contribute to these organisational differences.

RNs' acuity ratings (Papers II and III)

Several statistical calculations have been made to examine the RNs' allocation of acuity ratings. When looking at the results individually, there may not seem to be any pattern. However, when comparing the various results with each other, a pattern appears in which the RNs, despite being given the same information, reached different acuity ratings in many cases. Further, the majority of the RNs followed this pattern, and only a few participants targeted the expected acuity rating for many of the patient scenarios. Only limited explanations for these variations were found when looking at the personal characteristics of the RNs, suggesting that nursing experience may be one factor that influences the ability to accurately triage patient scenarios.

In this project, inter-rater agreement was calculated using per cent and unweighted and weighted κ values. The results indicate that the acuity ratings allocated by the RNs, in relation to the expected acuity ratings (allocated by the expert group), were moderate to good. In comparison with other patient scenario-based studies, the present results range from slightly less (weighted κ) to better (unweighted κ) (Dilley and Standen 1998, Considine et al. 2000, Manos et al. 2002), but the results are still troubling.

The result showing an accurate acuity rating of 57.7% is concordant with two Australian scenario-based studies, where the results ranged from 56.6 to 58% accurate decisions (Considine et al. 2000, Considine et al. 2004). However, in comparison with two Australian studies, which reported unweighted κ-values of 0.25 and 0.43, the result of 0.46 in this research project is higher (Dilley and Standen 1998, Considine et al. 2004). The κ-

value of 0.46, however, indicates only moderate agreement, and the matter of whether this is an acceptable level of agreement is not settled. However, the present result of 0.71 weighted κ statistics is somewhat lower than Canadian and American scenario-based studies; 0.80, 0.84, and 0.88-0.98 (Beveridge et al. 1999, Manos et al. 2002, Worster et al. 2004).

The indication of moderate to good inter-rater agreement in RNs' acuity ratings found in the present project is encouraging. Still, it means that only a little more than half of the acuity ratings allocated were in accordance with the expected acuity rating. Another discouraging finding was that, when analysing the data as either correct or false using unweighted κ, only moderate agreement was observed.

The analyses of the percentage of accurately triaged patient scenarios per RN and the RNs concordance adds further to the picture of variation in ED triage. The results show that about 20% (n=89) of the RNs triaged less than every second patient scenario accurately, and only a small number of RNs (n=79) allocated more than 70% of their acuity ratings correct. The dispersion of acuity ratings across several triage levels, as well as the variation of RNs rating the acuity in agreement with their colleagues further indicates that the RNs did not often agree with their colleagues' ratings. Other studies, conducted in Australia using patient scenarios, (Doherty 1996, Dilley and Standen 1998, Considine et al. 2000) reported similar results or higher levels of agreement in comparison to the dispersion across several triage levels and in accord with the RNs in the present research project. The Australian studies also reported that not one patient scenario was triaged into one triage level by all RNs, and none of the studies reported dispersion across five triage levels as found in this dissertation.

The present results indicate that, given the same information, a large group of RNs comprehend this information in different ways, and thus, make varying and partly incorrect decisions. The dispersion of acuity ratings across several triage levels supports this indication.

The statistical analyses provided limited support for relationships between the RNs' personal characteristics and accuracy in allocation of acuity ratings, suggesting that nursing experience to some extent influences the RNs ability to allocate accurate acuity ratings. However, regarding the "experts", based on the definition by Patricia Benner (1984), with context-bound nursing experience for more than five years, no evidence was found that those RNs were more accurate in their allocation of acuity ratings than their colleagues with less than five years experience. This result, in combination with the

significant but yet small, correlations when calculating the accuracy in relation to expertise based on continuous data (years), suggests that clinical nursing experience alone is highly unlikely to be the only explanation for the variations noted here.

The results presented above are consistent with those of other studies. For example, Considine and co-authors (2001) found no correlation between accuracy in allocation of acuity ratings to patient scenarios and emergency nurses' length of time in emergency nursing or triage experience. However, the authors did find that midwifery and tertiary qualifications were significantly related to accurate triage decisions. The results from a Canadian ED triage study showed that clinical experience did not correlate with triage accuracy (Worster et al. 2004).

Triage decision making (Paper IV)

RNs use of multiple thinking strategies supports the notion of ED triage as a complex task (Purnell 1991, Geraci and Geraci 1994, Gertdz and Bucknall 2000). Already 15 years ago Purnell (1991) showed that triage nurses conduct skilled tasks, which has been confirmed by American (Geraci and Geraci 1994) and Australian (Gertdz and Bucknall 2000) studies. Because the requirements for safe ED triage is not known, the lack of relationship between RNs' triage accuracy and their use of thinking strategies and structure of the triage process is a problem.

During triage, the RN assesses the patients in order to estimate the urgency based on their chief complaint and general appearance (Australasian College for Emergency Medicine 2000). The RN needs to collect data by asking questions, assessing the patient, measuring physiological parameters, and then evaluating these data before allocating an acuity rating. These steps were observed in the RNs' use of thinking strategies. For example, the data collection phase was visible by the RNs' use of the thinking strategy *searching for information*, as well as *making choices* to collect additional information. The evaluation phase was also visible in the RNs' use of the thinking strategies *judging the value* and *generating hypotheses*. The allocation of acuity ratings was visible by the RNs' use of the thinking strategies *making choices* (about acuity ratings), *forming relationships* (between patient symptoms and acuity ratings), and *stating a proposition*.

The use of the thinking strategies *searching for information* and *making choices* (about data collection) during ED triage has been reported in other studies. Both Cioffi (1998) and Lyneham (1998) found in patient scenario-

based design studies that the triage nurses collected data during the process of decision making. The use of physiological data during ED triage in the current study was common, whereas the use of such data has been found to vary in other studies (Fry and Stainton 2005, Gerdtz and Bucknall 2001, Andersson et al 2006).

The RNs' use of *hypotheses generating* supports the findings of Lyneham (1998) and Cioffi (1998). The use of the thinking strategies *recognising a pattern* and *making predictions* indicates that the RNs used previous nursing experience during their decision-making processes. Such use of past experience has been reported in other studies investigating decision making during ED triage. In a post interview following the use of TA method using patient scenarios Cioffi (1998) found that the nurses referred to patient cases from previous triage situations, which is supported by the findings in the present study.

The RNs in the current project structured the triage process in several ways, where the most common approach to begin the process was by gathering data, followed by either hypotheses generation or allocation of acuity ratings. This structure is consistent with the four stages of decision making in the hypothetic-deductive approach identified by Elstein and colleagues (1978). In 1998, Lyneham, who investigated emergency nurses' decision making, reported that the RNs used a hypothetic-deductive approach during triage, which is confirmed by the findings in the present project. On the other hand, Lauri and colleagues (1998) reported that the decision-making process of nurses in intensive care settings included both intuitive and analytical components, as proposed in the Cognitive Continuum Theory. The findings in paper IV, showing that four RNs did not use a hypothetic-deductive approach and that nine RNs moved back and forth during the triage process, indicate that other approaches are just as common in ED triage.

The RNs were included in paper IV based on their differential accuracy in triage decisions in paper III. Hence, it is surprising that only small inter-group differences were found regarding thinking strategies and structure of the triage process. The presence of intra-group variations, in combination with the small inter-group differences, suggests that the thinking strategies and structure of the triage process do not determine RNs' triage accuracy. On the one hand, *generating hypotheses*, which helps the RN to identify patients' diagnoses or status, and hence helps the RN to conduct additional data collection, was more commonly used by the RNs with high triage accuracy. On the other hand, the use of the thinking strategies *forming relationship* and *providing explanations*, which are considered important

strategies in sound decision making, were more common among the RNs with low triage accuracy.

Because studies have not reported that variations in RNs' triage accuracy relate to ED experience (Jelinek and Little 1996, Considine et al 2001) and because of the lack of support that other individual factors (such as the RNs' decision-making processes) may be important predictors of triage accuracy in paper IV, it remains an enigma as to what aspects are essential for the quality of RNs' triage decisions.

In summary, this study clearly shows that Swedish ED triage is characterized by variation (e.g., in the RNs allocation of acuity ratings). Because these variations may compromise patient safety, certain actions need to be taken. The variations in organisation of ED triage can be minimised if efforts are made, such as introducing designated triage nurses and suitable triage facilities. Further research is needed to explore the determinants of ED RNs triage accuracy.

Methodological discussion

Paper I, which was a population-based study targeting all hospital-based EDs, used telephone interviews in order to increase the number of interviews possible, facilitate data gathering, and increase the response rate. The use of other methods (such as questionnaires) would most likely not have revealed the same knowledge as the interviews. However, by visiting participating EDs, a deeper understanding regarding the triage facilities might have been gained, but would have precluded a national sample.

Content and design of the interview guide were informed by three specific studies (Purnell 1991, Geraci and Geraci 1994, Palmquist and Lindell 2000). It cannot be ruled out that the participants in paper I answered in a socially desirable way, which may have influenced the internal validity of the study. Given the large sample in paper I (87% of all Swedish hospital-based EDs), threats to external validity are considered limited.

The questions addressed to the RNs in papers II and III were based on two specific studies (Jelinek and Little 1996, Considine et al. 2001), together with the results of paper I. Due to ethical and methodological difficulties in using live triage situations, patient scenarios were used. This choice was guided by several studies (Dilley and Standen 1998, Beveridge et al. 1999, Fernandes et al. 1999, Considine et al. 2000, Eitel et al. 2003). Even though the patient scenarios were designed to resemble real-life situations, other factors that may influence the triage decision (e.g., lack of time and multiple patients waiting) (Gerdtz 2003, Dello Stritto 2005) were not simulated.

There were three main reasons for choosing a patient scenario-based design in this study. First, the project could not have been carried out based on real life triage. The purpose of the paper was to investigate RNs across the country in order to measure their inter-rater agreement. As mentioned below, this question cannot be answered without using the same data, i.e. the same patients or patient scenarios. Second, the absence of a national triage scale prevented the use of real life triage situations. Because the triage decisions carried out need to be comparable, only one triage scale could be used. However, from a patient safety perspective, it would not have been ethically acceptable to have RNs triage patients with a scale not previously used by them. Third, the lack of formal triage areas in many EDs also prevented a real-life triage design, because such a design would have required the reorganisation of many EDs.

Patient scenario design studies in ED triage studies are amongst the most common methods and have been used throughout the world for decades. Patient scenario designed studies have been conducted when investigating triageurs' accuracy in triage decisions (Dilley and Standen 1998, Considine et al. 2000) and in the development and testing of triage scales (Beveridge et al. 1999, Eitel et al. 2003). From both research and clinical standpoints, there are several benefits of using patient scenarios. It is a cost and time effective design, enabling large samples and it allows for inter-rater agreement calculations based on the same data, which is not possible when using a real-life triage design. From a clinical perspective, patients do not need to go through multiple triage situations, which is the case in real-life triage studies. Finally, the clinicians are not burdened by extra work (Worster and Fernandes 2005).

Whether results found in scenario-based designed studies are possible to generalise to live triage settings is not clear. Studies conducted in a real-life setting are few, and those that have been done yield ambiguous results (Wuerz et al. 2000, Worster et al. 2005). There are other factors (e.g., retrospective versus prospective design, sample size, and data analyses) that make comparisons between real-life versus patient scenario studies difficult. When comparing κ statistics from real-life triage and patient scenario based studies, such a comparison must be carried out with caution, as the results are dependent on the number of participants in each cell (Altman 1991).

Using ESI, Wuerz and co-workers (2000) reported weighted κ values that are higher for the data based on patient scenarios (0.83-0.96) than for data based on real patients (0.80). This is in contrast to a study by Worster and co-authors (2005), who found that inter-rater reliability was higher for triage

decisions based on actual patients (0.90) than patient scenarios (0.76). In 1997, Brillman and co-authors found in a study of agreement in triage between RNs and physicians, that when the physicians visually assessed the patients, the agreement between the two professions decreased from $\kappa = 0.45$ to $\kappa = 0.21$. However, the difference in agreement may depend on other factors as additional to the difference in information, such as triage levels and unclear chief complaints of the patients. Grafstein and co-authors (2003) used pairs of RNs and nurse researchers to conduct blind real-life triage. The RN triaged the patient while the nurse researcher, seated in the same room but without acting, followed the triage process and allocated the acuity rating suggested by a personal computer aid. The inter-rater agreement of the pairs was good (unweighted $\kappa = 0.66$ and weighted $\kappa = 0.75$), which is similar or lower compared with results reported by scenario–based studies (Manos et al. 2002, Worster et al. 2004).

Considine and co-workers (2004), using paper-based (text only) and computer-based (text and photographs) patient scenarios, found that the scenarios containing photographs in addition to text yielded higher inter-rater agreement than the scenarios with only text. The results suggest that when the patient is visualised to the triageur, the inter-rater agreement increases, which is in contrast to the study conducted by Brillman et al. (1997).

Because of the lack of knowledge regarding patient scenarios versus real-life triage in the ED triage community, it is difficult to draw conclusions on whether the results found in patient scenario designed studies are possible to generalise to real-life triage settings. It is likely that, when using scenario-based studies, the inability to collect additional information and the use of sensory information influence the RNs triage decisions in a negative direction. Jelinek and Little (1996) suggest that live triage situations provide more information than patient scenarios and are therefore likely to result in higher agreement. The use of scenarios instead of actual patients might decrease the stress and time pressures on the RNs, which could influence the decisions in a positive way.

Given these aspects, papers II and III are to be understood as an attempt to investigate RNs triage decisions in a fictitious rather than in a clinical setting. Whether the results based on the patient scenarios are transferable to triage decisions made in real life settings is not known. However, given the large sample of 423 nurse, the diversity in accuracy (22-89%) per RN, and the low inter-rater agreement (0.46 unweighted κ, 0.71 weighted κ) indicate that the RNs judged the information provided in the scenarios

differently and therefore allocated different acuity ratings to the patient scenarios. The RNs interpretation of information in different ways suggest that the variation in the fictitious data may be transferred to the clinical setting, but not necessarily to the same extent as in the fictitious setting.

As previously described, a pilot study of the patient scenarios was carried out in which a test group made comments about the design and ease of use (face validity). This pilot study lead to some adjustments of the scenarios (Kazdin 2003). Content validity of the scenarios was guided by other studies using a similar design. Reliability of the scenarios was tested by inter-rater agreement, resulting in 80% or higher agreement (Brink and Wood 1998).

The decision to use CTAS was guided by results in paper I and by several literature reviews showing that the triage scale was reliable (Beveridge et al. 1999, Manos et al. 2002) and valid (Beveridge and Ducharme 1997). As noted previously, in this project only the time frames were visible to the participants, which is in contrast to the above-mentioned papers. It cannot be ruled out that this difference in design could have affected the results negatively.

The external validity of papers II and III is threatened by the fact that only 18 of the 40 original patient scenarios were used. The reduction in the number of scenarios resulted in an uneven distribution of patient scenarios in each triage level, which likely influenced the results in a positive direction. Because the overrepresented patient scenarios of levels 1 and 5 (n=10) were accurately triaged to a higher extent than the others, the results presented may not be possible to generalise to settings with a different case mix (Brink and Wood 1998).

The difference in accuracy of acuity ratings between non-surgical (60.3%) and surgical (54%) scenarios is likely explained by the absence of non-surgical level 3 scenarios, which were the scenarios that were least accurately triaged. The use of a convenience sample may also limit generalisation. It cannot be ruled out that the use of local data collectors may have contributed to the fact that RNs were chosen based on the perceptions of their skills to triage, and consequently, do not represent the population of all RNs. The above-mentioned threats to external validity suggest that the results presented here could possibly be confounded in a positive direction, i.e. the results would be lower in the population as compared with the present sample of RNs.

In concurrent TA method (paper IV) it is a common to use patient scenarios (Prime and Le Masurier 2000, Offredy 2002). An assumption of the TA method is that verbalisation does not interfere with the ongoing cognitive processes (Ericsson and Simon 1993), meaning that what is captured in TA

method reflects the person's actual cognition. However, the lack of contextual information provided for the RNs (such as staffing and other patients waiting to be triaged) has been found to influence triage nurses' decision making (Gerdtz 2003, Andersson et al 2006), and hence, needs to be considered when interpreting the results. On the other hand, a TA study conducted in a critical care environment, using both fictional and actual patients, suggests that results from a scenario-based designed study may be representative of those taking place in actual patient care (Corcoran et al 1999).

The findings in paper IV cohere with a critical care study investigating RNs' decision making in a natural setting (Aitken 2003). Using TA method, the study reported that the participants used multiple thinking strategies and structured their decision-making process in a similar way as the RNs in paper IV. The similarities in results in the studies by Corcoran and co-workers (1999) and Aitken (2003) indicate that the results in paper IV reflect, to some extent, real-life triage.

One drawback in using scenarios has to do with the absence of feedback to questions asked by the RN or data on vital signs that the RN decides to check. This may have influenced the RNs' notable use of the thinking strategy *searching for information*. However, using concurrent TA method in an actual triage situation is difficult because it requires instant verbalisation of thoughts; however, triage is characterised by assessment of patients in small rooms with little privacy. Retrospective TA method in connection to real-life situations was also excluded because of the nature of the working conditions in triage, where RNs are under the pressure of time to begin a new triage assessment.

Issues related to trustworthiness, such as credibility, dependability, and transferability, were considered in paper IV (Graneheim and Lundman 2004). Despite the fact that contextual factors were not illustrated in the patient scenarios, it is believed that the scenarios stimulated the RNs' cognition in a similar way had it been a real-life triage situation. The fact that the results are supported by Cioffi (1998) and Lyneham (1998) strengthen the credibility of the findings. However, transferability of the results to the ED triage context is obscure because no study has been done investigating triage nurses' use of thinking strategies in a natural setting.

Dependability was achieved through the independent coding by three of the co-workers and the continuous discussions regarding the findings with the co-worker with expertise in TA methodology and nursing decision making.

The use of the previously identified thinking strategies as a coding scheme facilitated the initial phase of the analysis by providing a framework. However, it cannot be ruled out that other strategies might have been identified with an inductive approach. The use of content analysis provided new and important information about triage nurses' decision making. Further analyses of the data using protocol analysis might provide a more thorough approach in understanding RNs' decision making during triage.

The use of mixed methods contributed to a deeper understanding about Swedish ED triage. The quantitative papers showed that triage organisation varied greatly, as did performance, but could not really explain these variations. The variations were more thoroughly investigated by using a qualitative method, which helped in describing and comparing the RNs' use of thinking strategies and the way they structured the triage process. However, neither the quantitative nor the qualitative methods could fully explain why some RNs were more successful than others in accurately triaging fictitious patients.

Conclusions

- The Swedish ED triage context was found to vary greatly. Organisational variation was visible in the use of triageurs, the limited use of designated triage nurses, and in the use and design of triage scales. No obvious explanations have yet been provided to account for this variation.

- The large variations in how the RNs allocated acuity ratings to patient scenarios, both in comparison with their colleagues and a group of experts, suggest that in real life, variations in acuity ratings likely occur, but not necessarily to the same extent.

- RNs' decision making contained the use of several thinking strategies and the RNs structured the triage process in several ways, indicating that ED triage is a complex task requiring multiple cognitive strategies.

- No explanations have been forthcoming to account for variations in triage accuracy of RNs.

Implications

Because the current organisational variations constitute possible threats to patient safety, efforts to minimise the organisational differences in Swedish ED triage must be taken. It is crucial that triage nurses are provided with a reliable and valid triage scale and that they are given suitable locations. EDs that use administrative personnel and LPNs for triage need to consider the consequences of this strategy. It is therefore suggested that reorganisation of their current triage organisation should be considered.

The lack of a valid and reliable triage scale suitable for the Swedish ED triage context is a major inadequacy because this is a possible threat to patient safety. The National Board of Health and Welfare should pay attention to this crucial issue and take part in the development of a scale that has its foundations in the international triage literature. Furthermore, the scale must be applicable to the Swedish ED triage context.

The variations of accuracy in triage decisions based on patient scenarios must be followed up by studies conducted in the natural setting in order to understand triage accuracy in real patients. The results presented here indicate that there are variations in RNs triage accuracy even in real patients. This problem should be taken seriously, where employers, researchers, and the National Board of Health and Welfare need to discuss the consequences of such variation in relation to patient safety.

The identification of ED triage as a complex decision making task requiring multiple cognitive actions needs to be followed up in the natural setting. This is necessary in order to understand the influence of individual and contextual factors on triage decision making.

The lack of explanations to account for why some RNs have higher accuracy in triaging fictitious patients than others represents a major source of difficulty because it indicates that currently the qualifications needed for being a competent triage nurse is not known. Future research needs to pay attention to this issue.

Swedish ED RNs need to organise themselves on a national level, devoting time and effort to this demanding and challenging nursing task. They need to learn from each other as well as those countries that have studied this area of health care for several decades.

Notes

[1] En profil är den ordning sjuksköterskorna strukturerar triageprocessen.

[2] A triage nurse is an RN performing triage.

[3] Representative heuristic is a decision-making strategy influenced by previous experience, and plays a role in intuitive decision making.

[4] During the research project, one ED was closed down, resulting in 78 EDs.

[5] A profile refers to the order in which the RNs structured the triage processes.

[6] The use of a paediatric scenario relates to the fact that many EDs in smaller hospitals (regional and local) treat adults as well as paediatric patients, and hence the presence of a paediatric scenario helped to simulate a real-life setting.

[7] Designated triage nurse is defined as an RN scheduled to perform triage. The designated triage nurse is specifically appointed to triage, as opposed to a treatment nurse (also an RN) whose tasks may include triage but is not limited to that task.

[8] The allocated acuity rating is more acute than expected.

[9] The allocated acuity rating is less acute than expected.

[10] The information identified does not fit with a typical pattern.

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